

What is claimed is:

1. A reduced size GPS microstrip antenna comprising:
  - (a) a first dielectric substrate;
  - (b) a second dielectric substrate mounted on an upper surface of said first dielectric substrate;
  - (c) a ground plane mounted on a bottom surface of said first dielectric substrate;
  - (d) a shaped layer of etched copper mounted on an upper surface of said second dielectric substrate;
  - (e) first and second rectangular shaped quarter-wavelength microstrip antennas mounted on said upper surface of said second dielectric substrate, said first and second quarter-wavelength microstrip antennas being spaced apart from and electrically separated from said ground plane by said first and second dielectric substrates, said first and second quarter-wavelength microstrip antennas being adapted to receive an RF carrier signal containing GPS (Global Positioning System) data;
  - (f) said first quarter-wavelength microstrip antenna

20 being rotated ninety degrees with respect to said  
21 second quarter-wavelength microstrip antenna on the  
22 upper surface of said dielectric substrate;

23 (g) a feed network mounted on the upper surface of said  
24 first dielectric substrate, said feed network having  
25 one end of a first feed line and one end of a second  
26 feed line connected thereto, said first feed line  
27 having an opposite end thereof connected to said  
28 first quarter-wavelength microstrip antenna, said  
29 second feed line having an opposite end thereof  
30 connected to said second quarter-wavelength  
31 microstrip antenna, said first and second feed lines  
32 forming a power divider which provides for a phase  
33 shift of  $90^\circ$  of an electrical equivalent signal of  
34 said RF carrier signal when transmitted through said  
35 first and second feed lines; and

36 (h) said phase shift of said electrical equivalent signal  
37 and said first quarter-wavelength microstrip antenna  
38 being rotated ninety degrees with respect to said  
39 second quarter-wavelength microstrip antenna,

40                    providing for a circular polarization of said GPS  
41                    microstrip antenna.

1                    2. The reduced size GPS microstrip antenna of claim 1  
2                    wherein each of said first and second shaped quarter-wavelength  
3                    microstrip antennas has an overall length of 0.750 inches and  
4                    an overall width of 0.650 inches.

1                    3. The reduced size GPS microstrip antenna of claim 1  
2                    wherein each of said first and second quarter-wavelength  
3                    microstrip antennas is connected to said ground plane by a  
4                    plurality of copper plated through holes passing through said  
5                    first and second dielectric substrates.

1                    4. The reduced size GPS microstrip antenna of claim 1  
2                    wherein each of said first and second quarter-wavelength  
3                    microstrip antennas includes a copper feed which passes through  
4                    said second dielectric substrate and connects said first feed  
5                    line to said first quarter-wavelength microstrip antenna and

6        said second feed line to said second quarter-wavelength  
7        microstrip antenna.

1            5. The reduced size GPS microstrip antenna of claim 1  
2        wherein said reduced size microstrip antennas has a center  
3        frequency of 1.575 GHz and a frequency bandwidth of twenty  
4        megahertz.

1            6. The reduced size GPS microstrip antenna of claim 5  
2        wherein each of said first and second quarter-wavelength  
3        microstrip antennas includes a tuning tab for fine tuning the  
4        center frequency for said GPS microstrip antenna.

1            7. The reduced size GPS microstrip antenna of claim 1  
2        wherein each of said first and second dielectric substrates has  
3        a thickness of approximately .046 inches.

1            8. A reduced size GPS microstrip antenna comprising:  
2            (a) a first conical wedge shaped dielectric substrate;  
3            (b) a second conical wedge shaped dielectric substrate

4 mounted on an upper surface of said first dielectric  
5 substrate;

6 (c) a ground plane mounted on a bottom surface of said  
7 first dielectric substrate;

8 (d) a conical wedge shaped layer of etched copper mounted  
9 on an upper surface of said second dielectric  
10 substrate;

11 (e) first and second rectangular shaped quarter-  
12 wavelength microstrip antennas mounted on said upper  
13 surface of said second dielectric substrate, said  
14 first and second quarter-wavelength microstrip  
15 antennas being spaced apart from and electrically  
16 separated from said ground plane by said first and  
17 second dielectric substrates, said first and second  
18 quarter-wavelength microstrip antennas being adapted  
19 to receive an RF carrier signal containing GPS  
20 (Global Positioning System) data;

21 (f) said first quarter-wavelength microstrip antenna  
22 being rotated ninety degrees with respect to said  
23 second quarter-wavelength microstrip antenna on the  
24 upper surface of said dielectric substrate;

- 25 (g) a feed network mounted on the upper surface of said  
26 first dielectric substrate, said feed network having  
27 one end of a first feed line and one end of a second  
28 feed line connected thereto, said first feed line  
29 having an opposite end thereof connected to said  
30 first quarter-wavelength microstrip antenna, said  
31 second feed line having an opposite end thereof  
32 connected to said second quarter-wavelength  
33 microstrip antenna, said first and second feed lines  
34 forming a power divider which provides for a phase  
35 shift of  $90^\circ$  of an electrical equivalent signal of  
36 said RF carrier signal when transmitted through said  
37 first and second feed lines;
- 38 (h) said phase shift of said electrical equivalent signal  
39 and said first quarter-wavelength microstrip antenna  
40 being rotated ninety degrees with respect to said  
41 second quarter-wavelength microstrip antenna,  
42 providing for a circular polarization of said GPS  
43 microstrip antenna;
- 44 (i) each of said first and second quarter-wavelength

45 microstrip antennas including a tuning tab for fine  
46 tuning a center frequency for said GPS microstrip  
47 antenna, said center frequency for said GPS  
48 microstrip antenna being approximately 1.575 GHz; and  
49 (j) a first three-sided gap position around three sides  
50 of said first rectangular shaped quarter-wavelength  
51 microstrip antenna and a second three-sided gap  
52 position around three sides of said second  
53 rectangular shaped quarter-wavelength microstrip  
54 antenna, wherein an electromagnetic radiation pattern  
55 for said GPS microstrip antenna emanates from said  
56 first three-sided gap and said second three-sided  
57 gap.

1 9. The reduced size GPS microstrip antenna of claim 8  
2 wherein said first three-sided gap and said second three-sided  
3 gap each have a width of 0.050 inches exposing about 0.050  
4 inches of the upper surface of said second dielectric substrate  
5 in alignment with said first three-sided gap and said second  
6 three-sided gap.

1           10. The reduced size GPS microstrip antenna of claim 8  
2           wherein each of said first and second shaped quarter-wavelength  
3           microstrip antennas has an overall length of 0.750 inches and  
4           an overall width of 0.650 inches.

1           11. The reduced size GPS microstrip antenna of claim 8  
2           wherein each of said first and second quarter-wavelength  
3           microstrip antennas is connected to said ground plane by a  
4           plurality of copper plated through holes passing through said  
5           first and second dielectric substrates.

1           12. The reduced size GPS microstrip antenna of claim 11  
2           wherein said plurality of copper plated through holes comprises  
3           eighteen copper plated through holes.

1           13. The reduced size GPS microstrip antenna of claim 8  
2           wherein each of said first and second quarter-wavelength  
3           microstrip antennas includes a copper feed which passes through  
4           said second dielectric substrate and connects said first feed  
5           line to said first quarter-wavelength microstrip antenna and



6 said second feed line to said second quarter-wavelength  
7 microstrip antenna.

1 14. The reduced size GPS microstrip antenna of claim 8  
2 wherein each of said first and second dielectric substrates has  
3 a thickness of approximately .046 inches.

1 15. A reduced size GPS microstrip antenna comprising:  
2 (a) a first conical wedge shaped dielectric substrate;  
3 (b) a second conical wedge shaped dielectric substrate  
4 mounted on an upper surface of said first dielectric  
5 substrate;  
6 (c) a ground plane mounted on a bottom surface of said  
7 first dielectric substrate;  
8 (d) a conical wedge shaped layer of etched copper mounted  
9 on an upper surface of said second dielectric  
10 substrate;  
11 (e) first and second rectangular shaped quarter-  
12 wavelength microstrip antennas mounted on said upper  
13 surface of said second dielectric substrate, said

14 first and second quarter-wavelength microstrip  
15 antennas being spaced apart from and electrically  
16 separated from said ground plane by said first and  
17 second dielectric substrates, said first and second  
18 quarter-wavelength microstrip antennas being adapted  
19 to receive an RF carrier signal containing GPS  
20 (Global Positioning System) data, each of said first  
21 and second quarter-wavelength microstrip antennas  
22 being connected to said ground plane by a plurality  
23 of copper plated through holes passing through said  
24 first and second dielectric substrates;

- 25 (f) said first quarter-wavelength microstrip antenna  
26 being rotated ninety degrees with respect to said  
27 second quarter-wavelength microstrip antenna on the  
28 upper surface of said dielectric substrate;
- 29 (g) a feed network mounted on the upper surface of said  
30 first dielectric substrate, said feed network having  
31 one end of a first feed line and one end of a second  
32 feed line connected thereto, said first feed line  
33 having an opposite end thereof connected to said  
34 first quarter-wavelength microstrip antenna, said

35 second feed line having an opposite end thereof  
36 connected to said second quarter-wavelength  
37 microstrip antenna, said first and second feed lines  
38 forming a power divider which provides for a phase  
39 shift of  $90^\circ$  of an electrical equivalent signal of  
40 said RF carrier signal when transmitted through said  
41 first and second feed lines;

42 (h) said phase shift of said electrical equivalent signal  
43 and said first quarter-wavelength microstrip antenna  
44 being rotated ninety degrees with respect to said  
45 second quarter-wavelength microstrip antenna,  
46 providing for a circular polarization of said GPS  
47 microstrip antenna;

48 (i) each of said first and second quarter-wavelength  
49 microstrip antennas including a tuning tab for fine  
50 tuning a center frequency for said GPS microstrip  
51 antenna, said center frequency for said GPS  
52 microstrip antenna being approximately 1.575 GHz;

53 (j) each of said first and second quarter-wavelength  
54 microstrip antennas including a copper feed which  
55 passes through said second dielectric substrate and

56 connects said first feed line to said first quarter-  
57 wavelength microstrip antenna and said second feed  
58 line to said second quarter-wavelength microstrip  
59 antenna;

60 (k) a first three-sided gap position around three sides  
61 of said first rectangular shaped quarter-wavelength  
62 microstrip antenna and a second three-sided gap  
63 position around three sides of said second  
64 rectangular shaped quarter-wavelength microstrip  
65 antenna, wherein an electromagnetic radiation pattern  
66 for said GPS microstrip antenna emanates from said  
67 first three-sided gap and said second three-sided  
68 gap; and

69 (l) said GPS microstrip antenna having a frequency  
70 bandwidth of twenty megahertz.

1 16. The reduced size GPS microstrip antenna of claim 15  
2 wherein said first three-sided gap and said second three-sided  
3 gap each have a width of 0.050 inches exposing about 0.050  
4 inches of the upper surface of said second dielectric substrate

5 in alignment with said first three-sided gap and said second  
6 three-sided gap.

1 17. The reduced size GPS microstrip antenna of claim 15  
2 wherein each of said first and second shaped quarter-wavelength  
3 microstrip antennas has an overall length of 0.750 inches and  
4 an overall width of 0.650 inches.

1 18. The reduced size GPS microstrip antenna of claim 15  
2 wherein said plurality of copper plated through holes comprises  
3 eighteen copper plated through holes.

1 19. The reduced size GPS microstrip antenna of claim 15  
2 wherein each of said first and second dielectric substrates has  
3 a thickness of approximately .046 inches.

1 20. The reduced size GPS microstrip antenna of claim 15  
2 wherein said copper feed for each of said first and second  
3 quarter wavelength microstrip antennas corresponds to a 100 ohm  
4 input impedance.